The Effect of Neighbourhood Perceptions on Adolescent Property Offending

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Number 11

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THE EFFECT OF NEIGHBOURHOODS ON ADOLESCENT PROPERTY OFFENDING

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The Edinburgh Study of Youth Transitions and Crime
2006

Published 2006 by Centre for Law and Society
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EH8 9YL

The views expressed in this report do not represent those of The Edinburgh Study's funding bodies or of The University of Edinburgh.

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KEY FINDINGS

Property crime is fairly uncommon amongst young people, although a small minority are involved from an early age and offend quite persistently. Vandalism is the most common form of property crime, whereas housebreaking and fire-raising are rare.

Three distinctive property offender groups were identified: an early onset group who desisted sharply from around age 14; a late onset group who increased their offending from age 13 to 15, before declining only slightly; and a chronic group of offenders who were consistently involved in the highest volume of property crime from age 13 to 17, although they did show a sharp decline in offending from age 15.

Neighbourhood characteristics at age 12 do play a part in influencing whether or not a young person starts property offending during early adolescence. Over and above this, young people's perceptions of their neighbourhood impact on their offending.

Young people who perceive their areas to be poorly controlled by the adults who reside there are more likely to start offending early.

Those who get involved in chronic property offending are significantly more likely than other young people to live in socially disorganised neighbourhoods, which are characterised by frequent population turnover and a high density of young people.

These findings provide support for initiatives which aim to empower communities to deal with offending at the local level by adopting strategies that emphasise a lack of tolerance towards crime and disorder amongst young people and which focus on improving social capital within residential neighbourhoods.

Area based initiatives aimed at preventing property crime amongst young people are most likely to be effective if they target adolescents at age 12 or under, whereas those who start offending later appear to be less influenced by neighbourhood conditions.

INTRODUCTION

The aim of this report is to examine young people's involvement in property crime and to assess whether such behaviour can be predicted by neighbourhood characteristics at an early age. A key aspect of this investigation is whether different offending trajectories are influenced to a greater extent by young people's perceptions of their neighbourhood or by the actual physical and social features of the neighbourhood itself. The report draws upon the findings of the Edinburgh Study of Youth Transitions and Crime and uses a range of data including the self reports of 4,328 young people and various neighbourhood-level data taken from the 2001 census, police records and a survey of community residents. The key aims and methods of the research programme are summarized below.[1]

Aims of the programme

- To investigate the factors leading to involvement in offending and desistance from it
- To examine the striking contrast between males and females in criminal offending
- To explore the above in three contexts:
  - Individual development
  - Interactions with formal agencies of control
  - The social and physical structures of neighbourhoods
- To develop new theories explaining offending behaviour and contribute to practical policies targeting young people

Overview of methods

- Self report questionnaires (annual sweeps)
- Semi-structured interviews (40 undertaken in sweep 2)
- School, social work, children's hearings records (annual sweeps)
- Teacher questionnaires (1999)
- Police juvenile liaison officer and Scottish criminal records (from 2002)
- Parent survey (2001)
- Geographic information system

Participating schools

- All 23 state secondary schools
- 8 out of 14 independent sector schools
- 9 out of 12 special schools

Response Rates

- Sweep 1 96.2% (n=4,300)
- Sweep 2 95.6% (n=4299)
- Sweep 3 95.2% (n=4296)
- Sweep 4 92.6% (n=4144)
- Sweep 5 89.1% (n=3856)
- Sweep 6 80.5% (n=3531)

Research Team

- Lizzy Burgess, Lucy Holmes, Lesley McAra, Susan McVie, Paul Norris (left 2005), Jackie Palmer, David J. Smith

Study Funding

- Economic and Social Research Council (1998 - 2002)
- The Scottish Executive (2002- 2005)
- The Nuffield Foundation (2002 - 2006)

[1] See also Smith *et al* (2001) and Smith and McVie (2003) for further details about the study.

Context

There is a wealth of criminological literature showing that crime rates differ between types of residential neighbourhood, with higher levels of crime being commonly concentrated within more deprived and 'disorganised' communities.[2] Recently, there has been a growth in empirical research to identify the specific social and physical characteristics of neighbourhoods that have a direct effect on young people's offending behaviour, even when individual-level influences are controlled for (Wikstrom and Loeber 2000; Oberwittler 2004; McVie and Norris 2006). Nevertheless, there is still a gap in our understanding about the precise mechanisms by which such ecological factors influence young people's behaviour. One such gap is the extent to which it is the actual characteristics of the neighbourhood itself or the young people's perceptions of these characteristics which is the driving force behind their delinquent behaviour.

Neighbourhood perceptions

The effect of public perceptions on crime and disorder within neighbourhoods has been heavily researched in studies focusing on quality of life, perceptions of risk and fear of crime (Drukker and van Os 2003; Wilcox *et al* 2003). Research has shown that young people's perceptions of neighbourhoods have a strong impact on their quality of life and their risk avoidance behaviour (Bannister and Fyfe 2001; Drukker *et al* 2003). There is a particularly large literature on the biological impact of environmental factors on both the physical health (Sooman and Macintyre 1995; Ellaway *et al* 2001) and mental health (McKenzie *et al* 2002; Propper *et al* 2004) of a wide range of age and social groups. In a review of qualitative research, Attree (2004) reports on the disproportionate and often long term effects of neighbourhood deprivation on children's physical and emotional health and well-being. "Young people's accounts suggest that poor neighbourhoods present threats to well-being in terms of physical safety, perceived safeness, contested space and adult surveillance, all factors that could be described as area 'incivilities' (p686)."

While there has been much focus on the impact of neighbourhood perceptions on young people's health and well-being, much less is known about the psychosocial impact of neighbourhood characteristics on the propensity of young people to offend. Lynch (2000) makes the conceptual link between individual and social pathology, by arguing that people's perceptions of relative social status (based on income) within areas leads to an increase in negative emotions, such as shame and distrust, which cause poor health and health damaging behaviours, and can also foster anti-social behaviour, less civic participation and poorer social cohesion within communities. However, there is still a need to make the conceptual link from neighbourhood to individual and then social pathology.

[2] The work of the Chicago School of criminology was influential in identifying the process of 'social disorganisation' whereby certain communities are characterised by a high population turnover, failure to exhibit consistent non-delinquent values and lack of sufficient informal social controls over young people (Shaw and McKay 1942).

Trajectories of offending

Developmental or life-course criminology (Loeber and LeBlanc, 1990) and criminal careers approaches (Blumstein *et al* 1986) have become influential paradigms over the last two decades. Developmental criminology has highlighted the importance of disentangling the various complex pathways of offending within offender populations. Theory suggests that, within offender populations, there are distinctive groups with distinctive aetiologies that follow distinctive trajectories of offending behaviour through the life course. Criminal career theorists (Blumstein *et al* 1988) have identified the importance of identifying separate phases of offending such as onset, escalation and desistance. Both sets of theorists posit that distinctive risk factors can be identified to explain these forms of behaviour.

The two most influential taxonomic theories are those of Moffitt (1993) and Patterson (1996) who each identified two categories of offender: early onset persisters and late onset desisters. The persisters were characterised as a small group offenders involved in more frequent and serious offending, whose early misbehaviour gradually worsened and progressed into adulthood; while the desisters were a larger, transitional group of offenders who started to offend later, were involved in less serious and frequent offending, and generally desisted from offending during mid to late adolescence, with a much lower chance of being involved in crime in adulthood. These taxonomies were early examples of *a priori* classification, which assigns offenders to certain categories using deductive theory. Subsequent theorists have identified as many as eight groups of offender (see Ayers *et al* 1999), although critics of *a priori* classification claim that it is difficult to test in the real world and may fail to detect some naturally occurring groups (Chung *et al* 2002). Over the last decade, advances in statistical modelling methods have led to the development of other, more inductive methods for identifying offending trajectories on the basis of naturally occurring patterns of behaviour within groups (Nagin 1999, 2005). This method has also identified more than two offender types, although one must be careful that these are not merely a function of the underlying statistical approach (Laub and Sampson 2006).

Regardless of the method used, the trajectories approach opens up opportunities to examine which developmental factors are important in terms of explaining different pathways through crime. However, most studies have limited their search for aetiological predictors of trajectories to individual, family and peer factors because – according to Moffitt and Patterson's theories – chronic offending is assumed to be shaped by individual and family factors such as neuropsychological problems and coercive family processes, and late onset desistance to be associated with deviant peers. Chung *et al* (2002) improved upon this by expanding the list of factors to include school and neighbourhood related factors. However, they failed to take account of the effect of potential clustering at either the school or the neighbourhood level (which might make insignificant factors appear to be significant); and their neighbourhood measures were based on only two measures of young people's perceptions of their area with no objective measures of neighbourhood.

The policy context

A core element of contemporary social policy has been to diminish social exclusion and non-participation within communities, renew deprived areas and ultimately to reduce crime and disorder within areas by improving neighbourhood management structures and empowering local people to make decisions about the services and structures that affect their daily lives (Hills *et al* 2002; Social Exclusion Unit 2001). The Scottish Executive's commitment to involving communities in reducing crime and diverting young people towards more positive activities has been set out in a number of policy documents and included a range of initiatives, including Community Safety Partnerships, the Scottish Community Safety Network, the Better Neighbourhood Services Fund, Community warden schemes and Youth Cafes.[3] However, concern has been expressed about the governments' ability to control local neighbourhoods because the unpredictability of neighbourhood change appears to result in ever widening gaps in prosperity and fortune (Kearns and Parkinson 2001). There has also been criticism of the tendency to focus attention on the most deprived neighbourhoods without a proper understanding of the factors that impact most on people's lives (Ellaway *et al* 2001). For example, we do not know the extent to which we should be focusing on the psychosocial aspects of communities as opposed to the physical and structural aspects.

Aims of the report

This report aims to assess the extent to which young people's perceptions of their residential neighbourhoods, as compared with the physical features of the areas themselves, have an effect on their property crime offending trajectories during adolescence. This paper examines the impact of both neighbourhood characteristics and young people's perceptions of these neighbourhood characteristics on their involvement in property crime over the peak years of adolescent offending, from age 13 to 17. Multilevel modelling is used to simultaneously control for the effects of area level characteristics and the individual's perception of their area, as well as several other individual level characteristics that might have an effect on their behaviour. In addition, models of the young people's offending trajectories are used to assess whether neighbourhood characteristics and perceptions of neighbourhoods are predictive of some patterns of property crime more than others.

A key element of this paper is that it draws together two important fields of criminology (the ecological and the developmental) and combines two relatively new statistical methodologies (trajectory and multilevel modelling) to examine the impact of neighbourhood factors, both real and perceived, on young people's involvement in property crime.

[3] See Scottish Executive papers: *Safer Communities in Scotland* (1999); *A partnership for a better Scotland: Partnership Agreement* (2003); *Supporting Safer, Stronger Communities: Scotland's Criminal Justice Plan* (2004); Shiel, L., Clark, I. and Richards, F. (2005) *Approaches to community safety and anti-social behaviour in the Better Neighbourhood Services Fund programme.* Edinburgh: Scottish Executive Social Research.

Structure of the report

Part one of the report presents a descriptive analysis of the prevalence and variety of young people's involvement in property crime over six sweeps of data collection and presents the results of trajectory modelling which reveals four property crime pathways. The second part compares the characteristics of these four trajectory groups using a series of individual and neighbourhood level variables. Part three presents the results of a series of multilevel logistic regression models which identify those factors that predict involvement in different property crime trajectories during adolescence, focusing particularly on the importance of neighbourhood perceptions as compared with actual neighbourhood measures. The report concludes with a discussion of the key findings from the analysis and some policy relevant conclusions.

PART 1: INVOLVEMENT IN PROPERTY CRIME

This report focuses on property crime rather than other forms of offending as this is the form of offending that leaves evident scars on neighbourhoods (for example, vandalised buildings and fire damaged cars) and it has been theorised that the built environment is more likely to impact on people's perceptions than social structure, as it is more obvious (Wilcox *et al* 2003). It has also been proposed that signs of physical decay impact directly on people's offending behaviour (Wilson and Kelling 1982). This section of the report examines the extent of involvement of young people in property crime between the ages of 12 and 17**,** both in terms of prevalence and variety of offending. Trajectory analysis is then used to identify individual pathways of property offending between age 13 and 17.

Prevalence and variety of property crime

Members of the Edinburgh Study cohort were asked about their involvement in many different forms of delinquent behaviour over six annual sweeps, from the approximate age of 12 to 17. This included questions about four forms of property crime which are shown in the panel below. Overall, there was a very low degree of missing data over the six sweeps of the Edinburgh Study. Missing data were mostly due to non-response at any particular sweep rather than failure to answer, although attrition was relatively low. Missing data were dealt with using multiple imputation to correct for any potential bias (details of the imputation procedure are presented in appendix 1).

Questions on property crime:

- Did you break into a car or van to try and steal something out of it?
- Did you break into a house or building to try and steal something?
- Did you damage or destroy property that did not belong to you on purpose (e.g. windows, cars or street lights)?
- Did you set fire or try to set fire to something on purpose (e.g. a school, bus shelter, house etc)?

Figure 1 shows that the prevalence of involvement in property crime was greatest for vandalism, which peaked at around age 14, and lowest for fireraising and housebreaking, which peaked slightly later at age 15. By adding up the number of types of property crime in which cohort members said they had been involved, a variety measure is created which is an ordinal scale ranging from zero for those involved in no property crime to 4 for those involved in all forms of property offending at each sweep. Figure 2 shows the changing proportions of cohort members who reported being involved in between zero and 4 forms of property crime from age 12 to 17. This shows that the majority of cohort members at each sweep were not involved in any form of property offending, and those who were tended to be involved in only one or two forms of offending. A very small proportion (between 1 and 3 per cent at each sweep) of cohort members reported involvement in either three or four types of property crime.

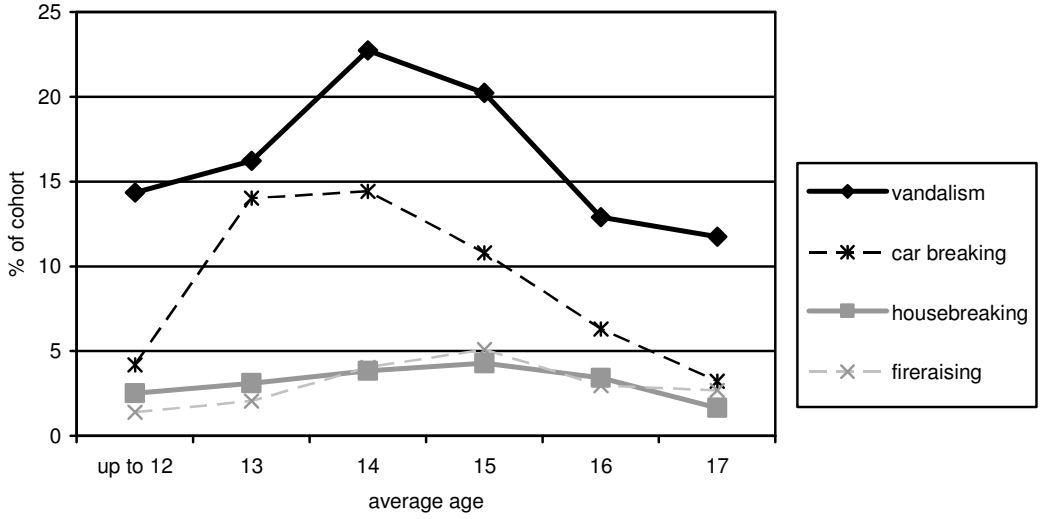

Figure 1: Prevalence of involvement in property crime, by type and age

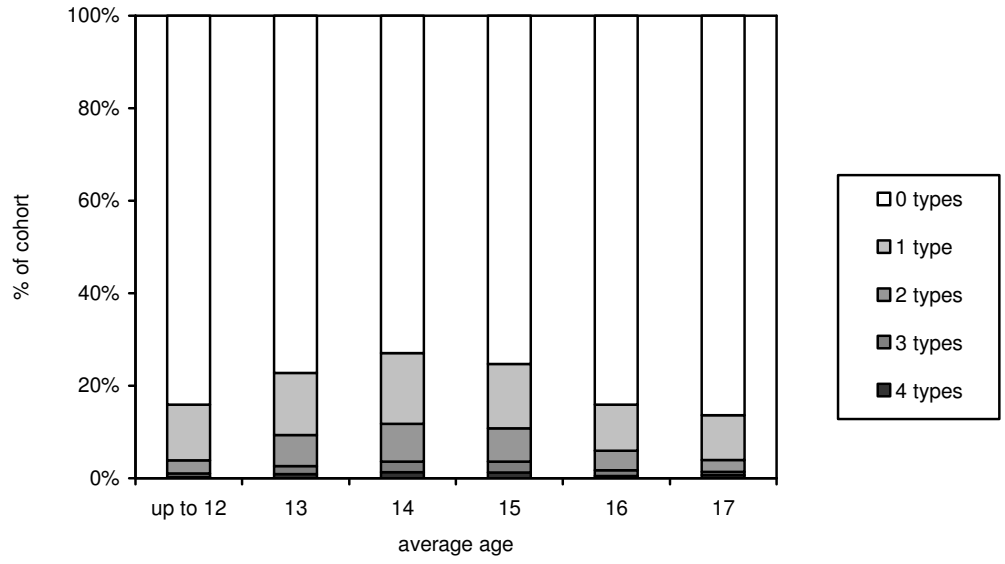

Figure 2: Variety (number of types) of property crime committed, by age

There was a very strong relationship between variety and volume of offending, in terms of the number of incidents young people said they had been involved in.[4] Correlation scores for variety and volume were 0.6 or greater for all six sweeps, and were highly significant ($p<.001$). This shows that those who were involved in more types of property offending were also likely to be the most chronic offenders in terms of frequency.

[4] Volume of offending was calculated by summing the number of incidents reported across the four property crime types (capped at a maximum of 11) producing a score ranging from 0 to 44.

Offending trajectories

Analysis of longitudinal offending data at the aggregate level (i.e. for the cohort as a whole) is valuable for indicating trends in behaviour over time; however, examining individual trajectories of offending allows us to better understand the various complex pathways into and out of offending. Recent advances in the development of statistical approaches to studying offending trajectories have made it possible to examine naturally occurring patterns of behaviour amongst large groups of people and such methods are perfectly adapted to longitudinal data. The most widely used of these are semi-parametric group based modelling (SGM) or latent growth mixture modelling (LGMM), both of which classify offenders into distinctive trajectory groups on the basis of observed offending histories, thus modelling sample heterogeneity in offending trajectories over time.

The analysis reported here is based on semi-parametric group-based modelling, which posits that within any population different individuals will exhibit specific trajectories in terms of their behaviour (for a comprehensive review of SGM see Nagin 2005). SGM was used to identify distinct groups of cohort members who had similar developmental trajectories in terms of their involvement in property crime from sweep 2 to 6 (age 13 to 17, approximately) using the variety of property crime measure.[5] Responses to the property offending questions given at sweep one (age 12) are excluded, for two main reasons: first, a different reference period was used at the first sweep ('ever') than subsequent sweeps ('during the last year') which makes responses non-comparable; and second, later analysis involves using potential explanatory variables from sweep one to predict later offending behaviour (a method also adopted by Chung *et al* 2002).

SGM analysis identified four trajectory groups using the variety of property crime measure across sweeps 2 to 6, as shown in figure 3.[6] Two thirds of cohort members were assigned to the 'non-offenders' group because they had little or no involvement in property crime at all during this period (although they may have been involved in other types of offending). The most common group of offenders (14.5 per cent of cohort members) are those labelled 'early onset desisters' who were involved in one or more property offences at ages 13 and 14, but then steadily reduced their offending and ceased by age 17. Just under 1 in 10 cohort members are described as 'late onsetters', as they were involved in little or no property crime at age 13, but gradually increased their involvement up to age 15 before declining marginally at ages 16 and 17. The final group are labelled 'chronic offenders' because of their consistently high variety of property offending. The chronic offenders (8.9 per cent of the cohort) peaked at around age 14 to 15 before declining at around the same rate as the early onset desisters.

[5] The analysis was conducted using the SAS add-on 'proc traj' (Nagin 1999). Variety of property crime was used rather than a volume measure as this required more complex analysis while producing similar results. For detailed discussion on the number of groups that were identified, see appendix 2.

[6] It is important to note that trajectory modelling is based on grouping individuals based on their statistical probability of homogeneity and taking the average score across individuals to form the trajectory. For this reason, and because of the small number of individuals committing more than 2 types of property crime at any sweep, the variety of property crime scale in figure 3 does not exceed 2.

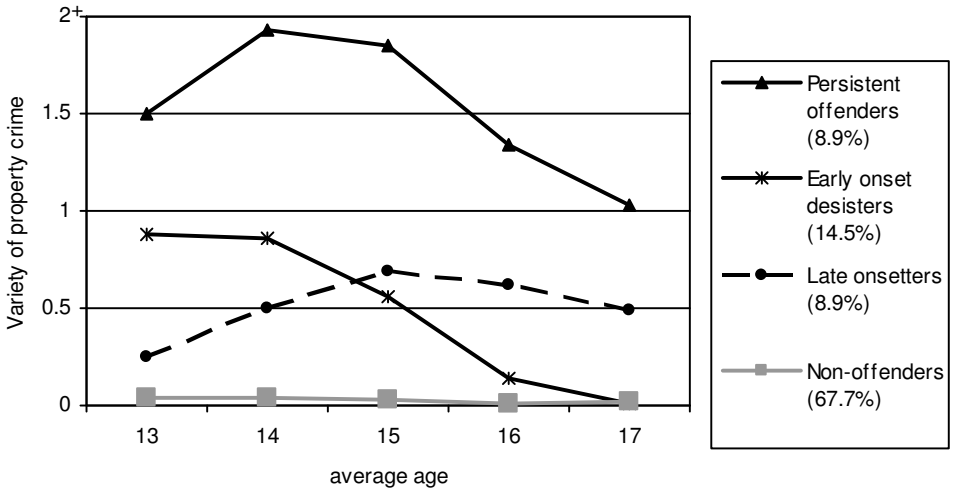

Figure 3: Trajectories of variety of property crime, from age 13 to 17

As mentioned above, the variety measure of property crime was highly correlated with the volume measure at each of the six sweeps of fieldwork. To test whether volume of offending was significantly different amongst the trajectory groups (i.e. to validate the longitudinal relationship between variety and volume of offending), the average volume of property offences committed was calculated for each group at each sweep and plotted in figure 4. Figure 4 shows an almost identical pattern to figure 3, which displays a very strong relationship between variety and volume amongst the trajectory groups. In other words, variety of property offending is a good proxy measure for volume of offending.

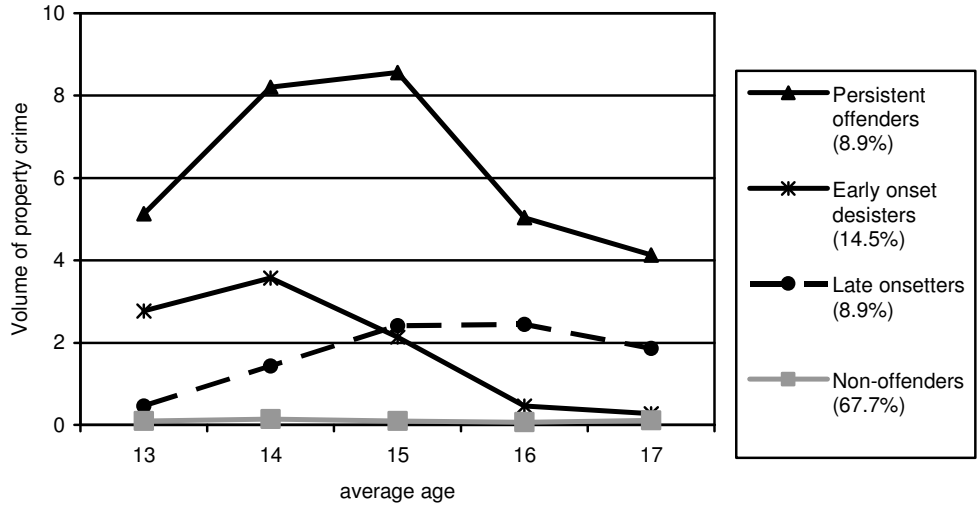

Figure 4: Volume of property crime amongst trajectory groups, from age 13 to 17

PART 2: CHARACTERISTICS OF PROPERTY CRIME TRAJECTORY GROUPS

The next phase of analysis involved conducting simple descriptive analysis of the characteristics of the different trajectory groups using a variety of both individual and neighbourhood level variables. The purpose of this analysis was to assess whether trajectory groups were distinguishable from each other, other than in terms of the heterogeneity of their offending patterns, using a range of potential explanatory factors. As far as possible, explanatory factors measured at sweep one of the study (age 12) were used for this element of the analysis since these measures occurred developmentally at a point prior to the start of the property crime trajectories at age 13 and, therefore, could be considered to be potential predictors of later behaviour. This is important for the next phase of analysis (presented in part three of this report).

Individual characteristics

A limited number of individual characteristics were selected for analysis in this paper on the basis that they were fixed or stable during adolescence and would be unlikely to be affected by the social or physical structures of the neighbourhood itself[7]. Four factors were identified as appropriate measures to include in this analysis: *gender, level of impulsiveness, socio-economic status* (according to the occupation of the head of household) and *parental separation* (experienced during adolescence or not). For a more detailed description of these four variables, see appendix 3.

Table 1 shows the profiles for each of the four trajectory groups based on these four individual variables. Overall, the greatest differences were found to be between those who were not involved in property crime and the three offender groups, with little difference emerging amongst the offenders themselves. The exception to this overall pattern is gender, as the proportion of males was significantly ($p<.05$) different within each group, being lowest for the non-offenders and highest for the chronic offenders.

Table 1: Individual profile of the four trajectory groups (% and means)

Individual level variables	**Non-offenders**	**Early onset desisters**	**Late onsetters**	**Chronic offenders**
% male	42.5	59.2	70.0	81.4
% manual/unemployed	40.9	55.4	52.3	49.4
% experienced parental separation by age 12	26.8	39.5	38.0	38.2
Mean impulsivity score at age 12* (0-100)	50.82	64.13	59.74	66.86

* analysis based on imputed data for missing cases.

[7] For further discussion of this approach, see McVie and Norris (2006).

The non-offenders were less likely (p<.05) to have manually employed or unemployed parents and were less likely (p<.05) to have experienced parental separation by the age of 12 than the offenders, but there was no significant difference between the three offender groups in either of these measures. Non-offenders were also far less likely (p<.01) to report being impulsive than the offenders, although there was no significant difference in the mean impulsivity scores amongst the offenders.

Individual perceptions of neighbourhoods

A further two individual factors are included in the analysis for this paper. These are individual perceptions of disorder or *incivilities* within the neighbourhood and perceptions of adult social controls or *collective efficacy* operating within the community (see appendix 3 for a detailed description of these variables). These measures are intended to act as alternative potential explanatory factors for young people's offending behaviour. As discussed in the introduction, there is evidence from other fields of research that perceptions of crime and disorder within neighbourhoods has some impact on young people's behaviour, but it is unclear whether it is these perceptions or the actual physical and social characteristics of the neighbourhood itself that has the greater effect.

Table 2 shows very little difference overall across the four groups in terms of whether they perceived there to be strong social controls amongst neighbours in their residential area. At age 12, non-offenders were slightly more likely (p<.05) than the early onset desisters and the chronic offenders to perceive there to be greater collective efficacy by adults in their neighbourhoods. However, there was no significant difference in the mean score for perceptions of collective efficacy between non-offenders and late onset offenders at age 12, which suggests that these two groups have very similar views at this early age. Mean scores for perceptions of neighbourhood incivilities were far lower than for social control, which shows a strong consistency of response (i.e. people generally perceived there to be good social controls and low disorder in their neighbourhoods). Once again, the non-offenders were less likely (p<.05) to report incivilities in their neighbourhoods than the early onset desisters and the chronic offenders. However, there was no difference between the non-offenders and the late onset offenders at age 12, which again indicates that these two groups are difficult to differentiate at this stage.

Table 2: Neighbourhood perceptions of the four trajectory groups (means)

Individual level variables	**Non-offenders**	**Early onset desisters**	**Late onsetters**	**Chronic offenders**
Mean perceived collective efficacy score (0-100) at age 12*	74.13	71.33	72.26	70.48
Mean perceived incivilities score (0-100) at age 12*	22.31	29.08	25.50	29.89

* Analysis based on imputed data for missing cases.

Neighbourhood characteristics

A range of independent area level characteristics were used to assess the relationship between neighbourhoods and involvement in property crime. Neighbourhood factors were found to have a limited impact on delinquency generally amongst the cohort at age 16 (McVie and Norris 2006); however, the analysis presented here is improved in two key ways. First, analysis focuses on property crime (i.e. crime involving theft from or damage to property which is likely to occur within neighbourhoods) rather than general delinquency.[8] Second, this paper uses longitudinal data to examine the impact of environmental factors on longer term patterns of offending and can be used to make more precise predictions about the effect of such factors on behavioural development.

Five neighbourhood measures are used in this paper. These are derived from three sources that are independent of the self-report data provided by cohort members: namely census data, police recorded crime data and a community survey of Edinburgh residents. Using a geographic information system (GIS), 91 distinct neighbourhoods were identified within the city, with an approximate population of between 4,500 and 5,000 in each.[9] Postcode data were collected from the school records of all cohort members at sweep one of the study, thereby allowing individuals to be allocated to one of these Edinburgh neighbourhoods at age 12 (for further details see appendix 3).

(i) Census data

The census provides a range of demographic, housing, health, education and cultural information about the population as a whole on a 10-yearly basis. Six variables from the 1991 census, which were identified as good indicators of social and economic stress or deprivation, were used in the derivation of the 91 Edinburgh neighbourhoods. Factor analysis identified two discrete latent variables from these six census variables: a measure of *neighbourhood instability* and a measure of *economic deprivation* (details of the census variables used to construct these measures are shown in the panel below).

Measure of neighbourhood instability:

- % of the population who had lived in the area for less than 12 months (migration)
- % of the population aged between 10 and 24 (young people)

Measure of economic deprivation:

- % of households consisting of lone parents with dependent children (single parents)
- % of households with more than one person per room (overcrowding)
- % of households in local authority housing (LA renting)
- % of the population who are out of work (unemployment)

[8] It is likely that neighbourhood factors have a greater impact on some forms of offending rather than others; therefore, analysis here is restricted to forms of offending that are commonly reported within communities (rather than shoplifting or violence that often occur in more non-residential areas).

[9] For a more detailed discussion on how the neighbourhoods were constructed see Chapter 14 of Smith *et al* (2001) and Chapter 3 of Brown (2004).

For analysis purposes in this paper, updated data from the 2001 census were used to construct the measures of *economic deprivation* and *population instability*. Although attempts were made to utilise variables for analysis that were contemporaneous with the first sweep of the Edinburgh Study survey (this is further explained in part three of the report), it was decided to use 2001 census rather than 1991 census data. The main reason for this was that inter-censal changes in the geography of the city meant that data collected in 2001 was considered to bear a more accurate reflection of the neighbourhoods the cohort members were living in during 1998 than data collected in 1991. In any event, the level of correspondence between the 1991 and 2001 census measures was very high. The correlation scores for economic deprivation and population instability between these two census years were .963 and .884, respectively.

(ii) Police recorded crime data

There has been some debate about whether official crime data are more reflective of public reporting practices or police activities than actual levels of crime within areas (see Mawby 1985). Nevertheless, Mawby suggests that police data do accurately reflect differences between areas in actual rates of crime. Police recorded crime data for the city of Edinburgh collected during 1997 were used in the analysis for this report, as an independent measure of the amount of crime occurring in young people's neighbourhoods coinciding with the reference period of the first sweep of data collection. Given the particular focus of this report, analysis was restricted to *rate of property crime* within neighbourhoods as recorded by the police (i.e. vandalism, fire-raising, housebreaking and vehicle theft). Further details of this measure of crime are presented in appendix 3.

(iii) Community survey

Two further neighbourhood measures are used for the analysis in this report. These were taken from an independent survey of 1642 Edinburgh residents carried out in 2001. This survey involved face-to-face interviews with questions covering a range of issues about the characteristics of the neighbourhoods. Interviews were stratified to ensure an equal number of responses across each of the 91 neighbourhoods. Two measures from this community survey were used to measure perceptions of residents towards aspects of the neighbourhoods they were living in: level of disorder or *incivilities* and *collective efficacy.*[10] These measures were based on the same theoretical principles and the specific questions were broadly similar to those used with cohort members (see appendix 3). Although this survey was carried out in 2001 (3 years after the first sweep of the study in 1998), there is no other comparable measure of neighbourhood perceptions in existence. In addition, given the high correlation between the 1991 and 2001 census measures (discussed above) and between the police recorded crime rates for 1997 and 2001 (which had a correlation score of .933) it is unlikely that the responses of residents within these 91 neighbourhoods would have been greatly different if they had been measured three years earlier.

[10] Although the measure of incivilities is based on survey data rather than objective measurement of physical disorder within neighbourhoods, other studies have shown that there is strong correspondence between the two and that it is valid to use survey data to measure neighbourhood factors (Herrenkohl *et al* 2002).

Neighbourhood level analysis

Analysis of the five neighbourhood characteristics was carried out at the area level. This was achieved by aggregating the individual level data (i.e. on trajectories of offending) to the 91 distinct neighbourhoods with cohort members being allocated to neighbourhoods according to their home postcode at sweep one. The figures presented in table 3 were created by calculating the proportion of respondents in each of the trajectory groups who lived in each of the 91 neighbourhoods, and then calculating the correlation score between this proportion and each of the area level explanatory measures. So, for example, the negative correlation between economic deprivation and non-offenders shows that non-offenders were significantly less likely to live in areas with a high level of economic deprivation at age 12. Correspondingly, those living in areas with high economic deprivation at age 12 were more likely become an early onset desister or a chronic offender, although not necessarily a late onset property offender. Overall, table 3 shows that those who did not get involved in property offending tended to grow up in quite different neighbourhood types from those who became property offenders. The non-offenders were significantly more likely to live in prosperous, stable, socially ordered areas with low crime and disorder at age 12; whereas, the offender groups were more likely to live in areas characterised by problems of various types.

Table 3: Area characteristics of the four trajectory groups (correlation scores)

Spearman's rho

Area level variables	**Non-offenders (% in area)**	**Early onset desisters (% in area)**	**Late onsetters (% in area)**	**Chronic offenders (% in area)**
Economic deprivation score (2001 census)	-0.568**	0.491**	0.201	0.338**
Population instability score (2001 census)	-0.241*	0.061	-0.020	0.339**
Neighbourhood incivilities score (2001 community survey)	-0.391**	0.349**	0.091	0.260*
Collective efficacy score (2001 community survey)	0.325**	-0.310**	-0.052	-0.171
Property crime rate (1997 police recorded crime)	-0.271**	0.293**	0.022	0.098

Note: n=91, * =p<.05, ** =p<.01.

Amongst the offender groups, neighbourhood level factors were most significantly associated with early onset desistance and chronic offending. Areas with higher levels of deprivation, incivilities, property crime and poorer collective efficacy had higher proportions of young people who went on to become early onset desisters. Areas with higher levels of deprivation, incivilities and population instability also contained higher proportions of young people who went on to become chronic offenders. It is worthy of note that chronic offenders were not significantly more likely to live in areas with

higher recorded crime or poor social control at age 12. However, there was no significant association between any of the neighbourhood characteristics and the proportion of young people living in an area that became a late onset property offender. This suggests that such individuals may come from a wide spectrum of neighbourhoods and are not systematically concentrated in the most problematic areas. These findings indicate that it is important to study the early impact of neighbourhood factors on offending behaviour, since they may have a differential impact on the development of different types of property offending trajectories. The findings also suggest that area effects may have a greater impact on property offending that starts early in adolescence than on such behaviour that manifests itself in later adolescence.

PART 3: PREDICTING INVOLVEMENT IN PROPERTY CRIME TRAJECTORIES

Using simple descriptive statistics, we have shown that property crime trajectories between ages 13 and 17 are differentially (and to a greater or lesser degree) related to gender, socio-economic status, impulsiveness, experience of parental separation, perceptions of incivilities and social controls with the neighbourhood and a variety of physical and social neighbourhood characteristics at the age of 12. However, this form of analysis cannot ascertain the direction or relative strength of these relationships. To assess the relative importance of each factor in predicting young people's propensity to be in one property crime trajectory or another, it is necessary to estimate multivariate models in which the potential explanatory factors are controlled for simultaneously. In addition, because two levels of data were analysed in this report (individual and neighbourhood), it is essential to use a form of multilevel modelling that takes account of neighbourhood clustering.

Six binary logistic regression models were specified which allowed each of the four trajectory groups to be compared against the others, so as to explore which of the various individual and neighbourhood variables best predicted membership of one trajectory group compared to another (full details of the modelling procedure are given in appendix 4). As far as possible, explanatory factors measured at sweep one of the study (i.e. developmentally before the offence trajectories were measured) were used to identify early predictors of offence trajectory group membership.[11] All of the individual variables, including the young people's perceptions of their neighbourhood, were measured at the first sweep of data collection in 1998. In addition, postcodes for cohort members at sweep one were used to take account of clustering at the neighbourhood level.

In terms of the neighbourhood variables, police recorded crime data for 1997 (broadly contemporaneous with the reference period for the sweep one survey) were used. Although census data for 1991 were available, measures based on 2001 data were used as these were considered to provide a more accurate reflection of the of the city's neighbourhoods in 1998 than the earlier data. Unfortunately, the community survey variables were only measured in 2001 (at a mid-trajectory point); however, it is unlikely that the physical and social characteristics of these neighbourhoods would have changed significantly during the three year gap. Therefore, the neighbourhood measures are assumed to provide an accurate representation of the cohort members' residential characteristics at sweep one.

Tables 4 and 5 present the six final regression models in which the four property crime trajectory groups are systematically compared with each other, and indicates which of the explanatory variables measured at age 12 predicted later involvement in property crime. The coefficients presented in tables 4 and 5 indicate whether the explanatory variable was predictive in a positive or a negative direction. Coefficients for categorical variables are comparable, as are those for continuous variables (which were all

[11] This method was also used by Chung *et al* 2002.

standardised); however, coefficients between categorical and continuous variables cannot be directly compared due to the different units of measurement.

Table 4 presents those factors measured at age 12 that predicted later membership of the three offender groups (early onset desisters, late onsetters and chronic offenders) using the non-offenders as the reference category for each. Table 5 looks at the factors that predicted membership of each offender group using one of the other offender groups as the reference category. Thus, all possible combinations of 'group couplings' are tested.

The first point worthy of note is that table 4 (which uses the non-offenders as the reference category for each of the offender trajectory groups) contains a greater number of significant explanatory variables than table 5 (which includes only the offender groups). This confirms the assertion in part two of this report that the offender trajectory groups can be distinguished from the non-offenders more readily than they can be distinguished from each other, using the variables contained within this analysis at any rate. The biggest difference between the tables is in terms of the number of individual level variables that explain involvement in property offending, since the number of area level factors that are significant overall does not vary greatly between tables 4 and 5. However, the two tables indicate that more individual level factors distinguish between the groups (especially between the non-offenders and the offender groups) than neighbourhood factors. Furthermore, it is likely that the number of significant neighbourhood variables would be reduced further if other individual level explanatory variables were included in the model. This fits with other research that has indicated that the level of variance in offending explained by neighbourhood factors is relatively low in comparison to other explanatory variables (Oberwittler 2004).

Table 4 reveals a considerable degree of consistency between the models in terms of the individual variables that emerged as significant in differentiating the offending trajectory groups from the non-offenders. Members of all three property crime groups were more likely than the non-offenders to be male, to have experienced parental separation and to be more highly impulsive (these factors were all found to be significant in explaining delinquency generally in McVie and Norris 2006). For both the early onset desisters and the late onset offenders, coming from a less affluent family background also distinguished them from non-offenders, although this was not a significant explanatory variable for the chronic offenders.

Interestingly, none of the neighbourhood characteristics included in this analysis – whether actual or perceived – differentiated between the late onset offenders and the non-offenders at age 12. Given that these two groups were both involved in virtually no offending in terms of their trajectories at age 13 (see figure 3), and that the individual influences measured here are shared with the other offender groups, these findings suggest that the different offending pathways of late onset property offenders must be prompted by a range of other factors that were not included in these models.

Table 4: Logistic regression models predicting property crime trajectory group membership (between offenders and non-offenders)

Regression coefficients

Reference group:	**Non-offenders**		
Individual level variables	**Early onset desisters**	**Late onsetters**	**Chronic offenders**
Being male	.604	1.106	1.698
Manual or unemployed parents	.347	.310	
Experienced parental separation	.450	.492	.479
Level of impulsiveness	.589	.357	.727
Perceptions of collective efficacy	-.087		-.129
Perceptions of incivilities			
Area level variables			
Economic deprivation (2001 census)			
Population instability (2001 census)			.112
Collective efficacy (2001 survey)	-.135		
Neighbourhood incivilities (2001 survey)			
Police recorded property crime rate (1997)			

Notes: All variables with coefficients listed were significant at the p<.05 level.
Model adjusted to take account of clustering at the neighbourhood level

The early onset desisters and the chronic offenders were distinguishable from the non-offenders in terms of two neighbourhood characteristics at age 12, one real and one perceived in each case. Both the early onset and the chronic property offenders were more likely than the non-offenders to perceive themselves as living in areas that were characterised by poor collective efficacy, when controlling for all the other factors. Although none of the questions on collective efficacy specifically asked about property offending, it might be assumed that young people living in such areas were more likely to believe that they would get away with their offending as adults would be unlikely to check them. In addition, the measure of collective efficacy derived from the community survey of Edinburgh residents was also predictive of early onset property offending, although not of chronic offending. This finding strongly indicates that lack of informal social controls within neighbourhoods has a significant effect on the offending behaviour of young adolescents.

Chronic offending was also influenced by living in an area characterised by population instability, according to census measures of residential migration and the density of young people living there. This may fit with theories of social disorganisation which proposes that offending is caused by the disruption of social networks and ties within communities, due to such factors as residential turnover and migration, which results in the erosion of common values and an inability to maintain effective social order. It is possible that early exposure to such lack of social capital is a key determinant in later involvement in chronic offending. Interestingly, however, this analysis revealed no

relationship at all between trajectories of property offending and level of economic deprivation, signs of physical disorder or police recorded crime rates at the neighbourhood level.

The regression model results presented in table 5 reveal fewer significant variables and less consistency than the previous table. Overall, the three property crime trajectory groups are not easily distinguishable from each other in terms of the explanatory variables used in this analysis. Fewer variables, particularly at the individual level, emerged as significant in differentiating between the offender groups. Therefore, it may well be that other characteristics (such as parental controls, peer relationships, school influence or contact with the police) are more important in terms of predicting the pathways of different types of property offender. Nevertheless, some interesting observations can be made from table 5, particularly in relation to the chronic offenders.

Table 5: Logistic regression models predicting property crime trajectory group membership (amongst offenders only)

Regression coefficients

Reference group	**Late onset offenders**	**Early onset desisters**	**Late onset offenders**
Individual level variables	**Early onset desisters**	**Chronic offenders**	**Chronic offenders**
Being male	-.511	1.091	.586
Manual or unemployed parents	.237		
Experienced parental separation			
Level of impulsiveness			.327
Perceptions of collective efficacy			
Perceptions of incivilities			.146
Area level variables			
Economic deprivation (2001 census)			
Population instability (2001 census)		.134	.287
Collective efficacy (2001 survey)			
Neighbourhood incivilities (2001 survey)			
Police recorded property crime rate (1997)	.168		

Notes: All variables with coefficients listed were significant at the p<.05 level.
Model adjusted to take account of clustering at the neighbourhood level

Gender emerged as a strong factor in differentiating between property offender types, with the chronic offenders being far more likely to be male than either of the other two offender groups. This is consistent with what we know about gender and offending generally, that more serious offenders are more likely to be male (Moffitt et al 2001). In comparison to the early onset desisters, those who started offending later were also more likely to be male. Those who were involved in chronic property offending were

more likely than either of the other two offender groups to live in areas of population instability at age 12. This provides further evidence that persistent involvement in property offending may be partly explained by growing up in areas characterised by weakened social capital caused by frequent residential turnover and a high density of young, economically inactive residents.

In comparison to the late onset offenders, the chronic offenders were also more impulsive and more likely to perceive there being a greater level of incivilities within their local areas at age 12, although they were not more likely to live in disordered areas according to the community survey. The early onset desisters also differed from the late onset offenders by being more likely to come from a deprived family background and to live in areas with higher rates of police recorded crime. The chronic offenders and the early onset desisters were least distinguishable from each other from this analysis; however, the inclusion of more explanatory factors would be needed to build up a clearer picture of how these different offending trajectories develop. Interestingly, none of the offender groups were significantly different in terms of their perceptions of collective efficacy within neighbourhoods, although this was a strong finding in table 4.

CONCLUSION

The aim of this report was to examine young people's involvement in property crime during adolescence and to assess whether such behaviour could be predicted by neighbourhood characteristics at an early age. A key aspect of the analysis was to compare young people's perceptions of their neighbourhood with other independent measures of the physical and social characteristics of areas to see whether one influenced behaviour more than the other. The findings indicate that property crime is relatively uncommon amongst young people, although a small minority are involved from an early age and offend quite persistently. Trajectory analysis revealed four distinct groups: a group of young people who were involved in little or no property offending between age 13 and 17; an early onset group who started offending at age 13 or earlier and desisted sharply from around age 14; a late onset group who were involved in little offending at age 13 but who increased their offending up to age 15, before starting declining modestly; and a chronic group of offenders who were consistently involved in the most frequent and varied property offending from age 13 to 17, although they did decline from about age 15. Incorporating these trajectories into regression models identified that some characteristics of the neighbourhoods young people live in at age 12 do play a part in predicting whether a young person gets involved in property offending during early adolescence, although these are not as numerous as individual level factors in determining such behaviour.

A particular objective of this analysis was to assess the extent to which young people's perceptions of their neighbourhoods impacted upon their behaviour, in comparison with the effect of independently measured neighbourhood characteristics. The analysis indicates that perceptions do have an effect on behaviour that is independent of actual area characteristics; however, it cannot be concluded from the findings here that the influence of such perceptions has a greater effect on subsequent property offending behaviour than that of other area level measures. Nevertheless, perceptions of both collective efficacy and physical disorder within neighbourhoods emerged as significant in explaining certain forms of property offending.

Young people who got involved in property crime at an early age were more likely than non-offenders to perceive there to be poor collective efficacy in their neighbourhoods at age 12. These findings indicate that young people's perceptions of how the adult residents around them monitor and control the neighbourhood does impact upon their subsequent behaviour, even when controlling for a 'real' measure of such collective efficacy. Successful initiatives aimed at regenerating neighbourhoods may therefore need to take account of the psychosocial impact of such changes amongst young people. Perceived collective efficacy was not a significant factor in explaining why some young people became late onset property offenders, however, which indicates that such perceptions may have only a short term effect. Young people's perceptions of incivilities emerged as significant only in terms of differentiating the chronic offenders from the late onset offenders, which suggests that physical disorder within neighbourhoods is a far less important motivating factor than the prospect of getting away with their bad behaviour.

The finding that poor social control within neighbourhoods has a significant impact on the early offending behaviour of young people suggests that property crime might be prevented by improving the social ethos of local neighbourhoods, and at the same time enhancing the perceptions of pre-secondary school age children about the way in which their neighbourhoods are monitored and supervised. This provides support for the government's efforts to empower communities to deal with offending at the local level by adopting strategies that emphasise a lack of tolerance towards crime and disorder amongst young people. However, the fact that strength of the individual factors in determining property offending indicates that such neighbourhood level strategies may be of limited impact.

Interestingly, economic deprivation (as defined by census measures such as unemployment, overcrowding, rented tenure and single parent families) and indicators of physical incivility within neighbourhoods (as measured by the community survey) both failed to prove significant in terms of explaining involvement in property offending in any of the models presented here. In addition, the measure of police recorded property crime proved to be significant only in terms of differentiating early onset offenders from late onset offenders. In other words, initiatives that simply target the most deprived, disordered and crime-prone neighbourhoods may not necessarily be the most effective approach to reducing property offending amongst young people. On the other hand, the findings consistently indicated that young people growing up in unstable communities, characterised by high population migration and a higher than average density of young people, were at significant risk of becoming chronic property offenders. Identifying such socially disorganised neighbourhoods and implementing initiatives designed to increase social capital by improving social capital and community ties might be a far more effective preventative strategy.

Neighbourhood characteristics at age 12 were found to have most impact on those who start to offend early in adolescence – both the early onset desisters and the chronic offenders – but very little on those who start to offend later in adolescence. This is important because it suggests that growing up in a problematic neighbourhood has most impact on the property offending of very young people, whereas those who go on to offend later are far less influenced by their environmental surroundings. These findings indicate that crime prevention initiatives which attempt to address neighbourhood problems with the aim of tackling early involvement in property offending may have little impact on behaviour that starts later in adolescence. It seems likely that a range of other factors, not investigated here, are more important causal factors in this respect. Further attention needs to be paid to identifying factors from a wider range of domains that further explain the development of different property offending trajectories.

APPENDIX 1: METHOD OF IMPUTATION

A common problem associated with longitudinal analysis of survey data is missing data, caused either by respondent attrition whereby members of the cohort fail to answer a particular year's survey or by failure to respond to one or more items within the questionnaire. The software used to estimate trajectory group analysis includes is able to handle such occurrences provided a respondent provides data for at least two time points (Jones *et al* 2001; Nagin, 2005). Until recently, only relatively simple methods were available to deal with the problem of missing data in terms of explanatory variables, for instance pairwise and listwise deletion or substitution of a missing value with the population mean. These methods can have a large adverse affect on research finding through either introducing bias to estimations or reducing the overall sample size. Multiple imputation is a relatively new technique which is aimed at overcoming these problem (for an introduction to the technique and issues involved see http://www.multiple-imputation.com/).

In multiple imputation, the software uses all the available data in the sample to provide a probable estimate for any missing value. This process is repeated several times leading to the creation of several different datasets in which the originally missing data may be replaced by different estimates depending on the certainty with which the software feels it can predict the missing value (a previous example of this method being used in a paper similar to this research can be found in Chung *et al* 2002). These new datasets are then analysed and the results combined to provide one overall model. This method has being shown to produce more reliable results than the simple methods which were previously employed.

For the analysis presented in this report, a total of 10 imputed datasets were created, which is at the top end of the scale for the suggested number of datasets required for reliable analysis (Rubin 1987). The creation of the imputed dataset and the subsequent logistic regression analysis was conducted using the MICE package for Stata version 9 (Royston 2005).

APPENDIX 2: NUMBER OF TRAJECTORY GROUPS

Semi-parametric group based modelling (SGM) operates on the basis that a number of groups are specified and the programme then finds this number of groups according to the best statistical 'fit' of the data. This raises a key issue in trajectory analysis, which is how to decide on the optimal number of groups to select[12]. Nagin (2005) recommends using the Bayesian Information Criterion (BIC) to provide a statistical indication of the appropriate number of distinct groups. This involves creating a series of models which specify a different number of groups. The model with the BIC statistic closest to zero is considered to be the best fitting model. Figure A1 shows a graph of the BIC statistic for a series of models based on the variety of property crime measure, ranging from a model that specified only two groups to a model that specified six groups. Figure A1 suggests that the four group model is optimal for the variety of property crime measure i.e. amongst the Edinburgh Study cohort there are four clearly defined groups that show different trajectories in terms of their property offending. It should be noted, however, that it is also important to use common sense and theoretical reasoning in the selection of groups by observing the pattern of the trajectories that emerge.

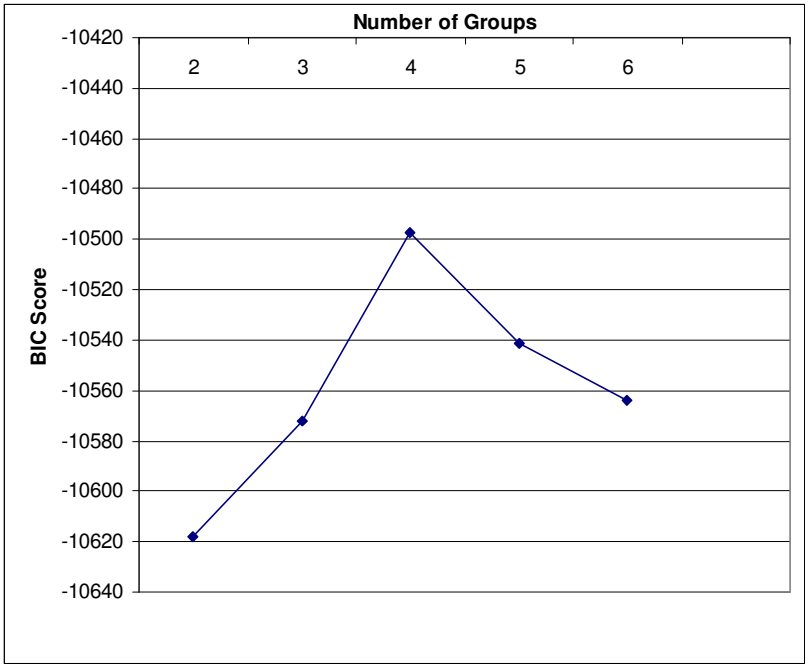

Figure A1: Bayesian Information Criterion for variety of property crime trajectories, by number of groups specified

[12] A systematic review of semi-parametric mixed Poisson regression modelling carried out by D'Unger et al (1998) concluded that four or five trajectory groups was usually sufficient.

APPENDIX 3: VARIABLES INCLUDED IN ANALYSIS

Gender

Initially, information on gender was collected from school records. However, over the course of five sweeps, this was enhanced by using self-reports and observation until data were known and verified for all cohort members. There was a virtually even gender split amongst the cohort members (51% male, 49% female).

Socio-economic group

At sweep one, respondents' descriptions of their parents' occupations were coded using the Registrar General Social Classification Scheme (RGSC). The socio-economic group (SEG) of the parent in the highest class grouping (with full time workers taking precedence over part time workers) was assigned to the child. Unfortunately, SEG could be assigned to only 61.4% of the cohort. At sweep four, a survey of parents' provided more precise and up to date information on SEG for 69.5% of the cohort. Despite the three year gap between the two sources of data, they were strongly correlated (0.637) showing considerable stability over time. Therefore, the sweep four SEG was used and, where this data was missing, sweep one data was substituted. This process produced a socio-economic group code for 88.3% of all cohort members. To make analysis simpler, and to allow reasonable leeway for error, the respondents were divided into two broad social class groupings according to whether their parents' occupation was classed as 'non-manual' (i.e. SEG groupings I, II and IIIa) or 'manual or unemployed' (i.e. SEG groupings IIIb, IV, V and unemployed). The proportion of individuals who were in the non-manual socio-economic group was slightly higher (56%) than those whose parents were either in manual work or unemployed.

Impulsivity

A modified version of the Eysenck Impulsivity Scale (Eysenck *et al* 1984) was used to measure lack of constraint amongst the cohort members at sweep one of the Edinburgh Study. The original measure had 27 items but this was reduced to six after careful piloting with a sample of 108 children prior to sweep one. Some changes of wording were made to make the statements more appropriate for the age group and the response format was changed to a 5-point verbal scale (from strongly agree to strongly disagree). The individual items used in the questionnaire were:

- Planning takes the fun out of things
- I get into trouble because I do things without thinking
- I put down the first answer that comes into my head on a test and often forget to check it later
- I get involved in things that I later wish I could get out of
- I sometimes break rules because I do things without thinking
- I get so excited about doing new things that I forget to think about problems that might happen

Each item was scored from 0 to 4, with a high score corresponding to a more impulsive personality. A high level of internal reliability was found between the individual items

at sweep one, with a Cronbach's alpha scores of .787. The composite impulsivity scale was created by adding the scores from the six items together, producing a range from 0 to 24.

Parental separation

At each sweep of the study, respondents were asked whether about their current family structure and who they lived with. If they spent some time in one household and some time in another, they were asked to distinguish these two households. Using the responses to these questions, it was possible to distinguish those who were living with both birth parents consistently across the five sweeps from those who had experienced some form of parental disruption or separation. Thirty one per cent of respondents reported experiencing parental separation at age 12.

Individual perceptions of neighbourhood disorder

We used the concept of 'incivilities' introduced by Wilson and Kelling in their famous article about 'broken windows' (1982) to mean signs of disorder which show that unwanted behaviour is not effectively controlled. Respondents were asked whether each of the following incivilities was a problem in their neighbourhood:

- Rubbish in the street
- Broken windows in shops or buses
- Vandalised or burnt out cars
- Dog dirt on pavements, grass, etc.
- People who are drunk in the street
- Gangs of young people
- Boarded up or burnt out houses
- Not enough street lights
- Graffiti on walls or building
- Vandalised buildings or bus shelters
- People selling drugs
- Drug needles (or syringes) lying around
- Busy roads or heavy traffic
- Neighbours fighting in the street

Each item was rated on a three-point scale (from 0 for not a problem to 2 for a big problem). The results were used to compute a 'perceptions of incivilities score' ranging from 0-28. This scale has very high reliability and internal coherence (cronbach's alpha=.9038 for sweep one).

Individual perceptions of social control

The young people's perception of social control within their neighbourhood was measured at sweep one in terms of what action the adults in their neighbourhood would take in certain problematic situations. The social control measure was based on the three questions shown below (these were developed from measures used by Sampson *et al* 1997).

- If someone was spray painting a wall in your neighbourhood, what would probably happen?
- If someone was trying to steal a car in your neighbourhood, what would probably happen?
- If teenagers were fighting in the street in your neighbourhood, what would probably happen?

At each question, the respondent had to say whether they thought 'an adult would try to stop them' and whether 'someone would call the police' (responses=yes, no or not sure). The 'yes' responses were used to create a six point scale ranging from 0 (poor social control) to 6 (good social control). This scale has a moderate score for reliability and internal coherence (cronbach's alpha=.548).

Cohort allocation to neighbourhoods

Address information for the cohort was collected at sweep one from school records. This was available for 3972 (92 per cent) of all eligible participants at sweep one. A small proportion of these (291) were not resident within the city of Edinburgh, therefore, a total of 3681 (85 per cent) of cohort members at sweep one were allocated to one of the 91 Edinburgh neighbourhoods at age 12. This meant that data from the individual respondents could then be viewed spatially across the city by aggregating responses on any variable, such as frequency of offending, to the neighbourhood level.

Police recorded crime data

Police recorded crimes for the calendar year 1997 within the City of Edinburgh were provided with postcodes of the locus of each incident. Unfortunately, these early data were not geo-coded by the police and this task had to be undertaken manually. Only 70% of incidents recorded could be successfully geo-coded, since insufficient information was provided about the location of the crime to enable eastings and northings to be assigned. Those incidents that could not be geo-coded (30% of the total) were not included in the analysis.

Each incident had a SOHD code, a standard crime classification defined by the Scottish Executive. Analysis of police recorded crime data was restricted to four crime categories relating directly to the forms of property crime reported by members of the Edinburgh Study cohort, as shown in the panel below. A total property crime count for each of the 91 neighbourhoods was calculated by summing the incidents of these 4 crime types, and then expressing this as a rate per 1000 of the population within each neighbourhood to provide a standardised measure for comparison.

Composite police recorded crime categories:

1. Vandalism.
2. Fire-raising.
3. Theft from motor vehicles (including attempts).
4. Theft by housebreaking (including attempts) and housebreaking with intent to steal.

Community survey

In 2001, the Scottish Executive funded a separate survey of Edinburgh residents as part of the doctoral work of a post-graduate student attached to the Edinburgh Study (Brown 2004). This survey involved face-to-face interviews with an achieved sample of 1642 respondents, stratified across the 91 neighbourhoods of Edinburgh. The Postal Address File for Edinburgh provided the sampling frame. Due to financial constraints, a quota sample rather than a random sample was used. Quotas of approximately 18 respondents per area were selected, based on age, sex and working status (calculated on the basis of the 1991 census). The precise details of the survey can be found in Brown (2004).

The questions used in the survey were almost all adapted from other, validated questionnaires, including those from the Chicago Neighbourhood Study, the Housing Attitude Survey, the Scottish Household Survey and the Edinburgh Study of Parents. The measures collected included two continuous variables which were used to form the analysis for this report. These were a scale of perceived incivilities within the neighbourhood and a measure of collective efficacy amongst neighbours. The precise questions used to construct these scales are shown in the panel below. Both measures had a very high level of reliability (cronbach's alpha for neighbourhood incivilities = .839; for collective efficacy = .713).

Neighbourhood variables collected in the community survey:

1. **Neighbourhood incivilities**. Eight items rated from 'not at all common' to 'very common' in the neighbourhood: "noisy neighbours or loud parties", "vandalism, graffiti or other deliberate property damage", "groups of youth people hanging around on the street", people who have been drinking or taking drugs", "rubbish or litter lying around", "abandoned or burn out cars", "used syringes lying around" and "derelict or empty houses". Scale ranged from 0 to 32, where 32 indicated a high level of incivilities.
2. **Collective efficacy**. Three items rated from 'very likely' to 'very unlikely': "if a group of local children were skipping school and hanging out on a street corner, how likely is it that you or your neighbours would do something about it?", "if some local children were spraying graffiti on a local building, how likely is it that you or your neighbours would do something about it?" and "if there was a fight in front of your house and someone was being beaten up or threatened, how likely is it that you or your neighbours would break it up or call the police?". Scale ranged from 0 to 12, where 8 represented a high level of collective efficacy amongst neighbours.

APPENDIX 4: DETAILS OF THE REGRESSION MODELS

The regression models presented in this paper were created using the binary logistic regression routine in Stata Version 9. The models fitted by this routine are suitable for analysing dependent variables where each respondent is coded as 1 if they belong to the group of interest (e.g. offenders) and 0 if they do not (e.g. non-offenders). Binary logistic regression was selected over multinomial regression to allow analysis between the offender groups as well as between the offender groups and non-offenders. To allow comparison of each of the four property crime trajectory groups against the others (group coupling), six logistic regression models were constructed.

A series of models were specified for each group coupling starting with a null-model (Model 0) containing only the dependent variable and the constant term but allowing for clustering at the neighbourhood level. This provides a coefficient for the intercept which indicates the level of variance in the dependent variable that is explained purely by area clustering. Model 1 was run containing the four individual explanatory factors (not including perceptions of neighbourhoods) and backward deletion was used to eliminate the variable with the highest p-value at each stage, until only those variables meeting the criterion p-value of less than 0.05 remained. Model 1 formed the basis for each of the subsequent models. Model 2 contained each of the significant individual variables and the two individual neighbourhood perception variables, of which the significant ones were used in the final model. Models 3 to 7 contained the significant individual variables and tested each of the five neighbourhood level factors, using a sequential selection procedure, wherein each variable was entered into the model individually and in combination with the others to establish the best model fit. The final model (Model 8), summarised in tables 4 and 5, represented the best fitting models overall containing each of the significant variables from the previous 7 models.

Multilevel modelling was achieved by using the clustering function in Stata which takes into account the fact that cohort members are not independent of each other, but are grouped together by virtue of the fact that they live in the same neighbourhoods. The clustering function takes account of this by adjusting the standard errors appropriately, and reduces the likelihood of neighbourhood factors appearing to be significant within the regression models when in fact they are not.

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This report is part of a series of research digests presenting key findings from the Edinburgh Study of Youth Transitions and Crime. This is a longitudinal study exploring pathways in and out of offending for a cohort of over 4000 young people, since 1998.

The research has been funded by:

The Scottish Executive	
The Nuffield Foundation	
The Economic and Social Research Council	R000237157
	R000239150

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ISBN 0-905893-11-5

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